

U.S. PTO Customer No. 25280

Case# 5258

**CLAIMS**

1. (Amended) An automated process for coloring a superpixel, defined within a computer aided design system, containing a specified number of constituent pixels N and using a pre-defined set of process colors, for use in coloring a pattern area on an absorbent substrate having a specified target color, said process comprising the steps of:
  - a. determining the color component values of said set of process colors and the color component values of said target color, wherein said color component values of said process colors, as defined, include an accommodation for the reflectivity of said substrate;
  - ab. defining a combination of said process colors, each of said process colors having an individually specified concentration to be assigned to said superpixel that, when blended together, will produce said target color, wherein said assignment of process colors to specific constituent pixels is constrained by a minimum specified concentration; and
  - bc. determining, within said combination of said process colors of Step (ab), an assignment of specific concentrations of said process colors to specific constituent pixels that produces a desired distribution of colorants within said superpixel.
2. Cancelled.
3. Cancelled.
4. Cancelled.
5. (Original) The process of Claim 4 wherein said accommodation involves the use of the Kubelka-Munk  $k$  over  $s$  relationship.

U.S. PTO Cust mer No. 25280

Case# 5258

6. (Original) The process of Claim 5 wherein said accommodation includes wicking characteristics.
7. (Original) The process of Claim 5 wherein said accommodation includes density characteristics.
8. (Amended) The process of Claim 1 wherein, in Step (b~~c~~), said assignment of specific concentrations of said process colors results in an assigned total concentration of process colors within a constituent pixel that exceeds 100 percent.
9. (Original) The process of Claim 1 wherein said desired distribution is one that maximizes the uniformity of said distribution of colorants within said superpixel.
10. (Amended) The process of Claim 1 wherein, in Step (b~~c~~), said desired distribution is determined using a Sum of Squared Deviations calculation.
11. (Amended) The process of Claim 1 wherein, in Step (b~~c~~), said assignment of specific concentrations of said process colors is made by successive rotations of a Bayer Threshold Order Array for each colorant in order to minimize a Sum of Squared Deviations calculation.
12. (Original) The process of Claim 1 wherein said superpixel is used to tile a uniformly colored pattern area.
13. (Amended) The process of Claim 2~~1~~ wherein said superpixel is used as a dithering element to color a pattern area.
14. (Amended) The process of Claim 1 wherein, in Step (b~~c~~), said combination of process colors includes a specified concentration of a specific process color that is less than said minimum specified concentration, and which is greater than said minimum specified concentration divided by N, and wherein said specific process color is non-uniformly assigned among said N constituent pixels.

U.S. PTO Customer No. 25280

Case # 5258

15. (Amended) The process of Claim 21 which further includes the following step:
- d. displaying said pattern containing said superpixel on a computer monitor.
16. (Original) The process of Claim 15 which includes displaying individual pixels comprising said superpixel, prior to inter-pixel commingling, on a computer monitor.
17. (Original) The process of Claim 15 which further includes the step of automatically generating instructions for actuating colorant applicators to reproduce said pattern displayed on said monitor on said absorbent substrate.
18. (Amended) A process for coloring a superpixel, containing a specified number of constituent pixels N and using a pre-defined set of process colors, for use in coloring a pattern area on an absorbent substrate having a specified target color, said process further providing for the display of said target color expressed by said superpixel, comprising the steps of:
- a. defining the color component values of said process colors, wherein said color component values include an accommodation for the reflectivity of said absorbent substrate;
- b. defining a combination of said process colors of specified concentrations to be assigned to said superpixel that, when blended together, will produce said target color, wherein said assignment of process colors to specific constituent pixels is constrained by a minimum specified concentration;
- c. determining the color component values of said target color; and
- d. determining, within said combination of said process colors of Step (b), an assignment of specific concentrations of said process colors to specific constituent pixels that produces a desired distribution of colorants within said superpixel.
19. Cancelled.

U.S. PTO Customer No. 25280

Case# 5258

20. (Amended) The process of Claim ~~49~~18 wherein said accommodation involves the use of the Kubelka-Munk ~~k~~ ~~over~~ ~~s~~ relationship.
21. (Original) The process of Claim 20 wherein said accommodation includes wicking characteristics.
22. (Original) The process of Claim 20 wherein said accommodation includes density characteristics.
23. (Original) The process of Claim 18 wherein, in Step (d), said assignment of specific concentrations of said process colors results in an assigned total concentration of process colors within a constituent pixel that exceeds 100 percent.
24. (Original) The process of Claim 18 wherein said distribution is one that maximizes the uniformity of said distribution of colorants within said superpixel.
25. (Original) The process of Claim 18 wherein said desired distribution is determined using a Sum of Squared Deviations calculation.
26. (Original) The process of Claim 18 wherein, in Step (d), said assignment of specific concentrations of said process colors is made by successive rotations of a Bayer Threshold Order Array for each colorant in order to minimize a Sum of Squared Deviations calculation.
27. (Original) The process of Claim 18 wherein said superpixel is used to tile a uniformly colored pattern area.
28. (Original) The process of Claim 18 wherein said superpixel is used as a dithering element to color a pattern area.
29. (Original) The process of Claim 18 wherein, in Step (b), said combination of process colors includes a specified concentration of a specific process color that

U.S. PTO Custom r No. 25280

Case# 5258

is less than said minimum specified concentration, and which is greater than said minimum specified concentration divided by N, and wherein said specific process color is non-uniformly assigned among said N constituent pixels.

30. (Original) The process of Claim 18 which further includes the following step:

e. displaying said target color containing said colored superpixel on a computer monitor.

31. (Original) The process of Claim 30 which further includes displaying individual pixels comprising said superpixel, prior to inter-pixel colorant commingling, on a computer monitor.

32. (Original) The process of Claim 30 which further includes the following step:

f. automatically generating instructions for actuating colorant applicators to reproduce said pattern displayed on said monitor on said absorbent substrate.

33. (Original) The process of Claim 32 wherein said instructions are sent to an array of liquid colorant applicators, each applicator being adapted to apply a liquid colorant that corresponds to a process color onto an absorbent substrate in accordance with said generated instructions.

34. (Amended) For a desired pattern containing a target color, a process for reproducing said target color in pixel-wise fashion on an absorbent substrate using a pre-defined set of process colorants, each of said process colorants expressing a specified process color, said target color being expressed through the formation of at least one superpixel, said superpixel being comprised of a group of contiguous individual pixels to each of which an individual color may be assigned, said assignable individual color corresponding to the inherent color of said substrate as modified by the optional direct application of process colorant, as required by said pattern, to said substrate in pixel-wise fashion, said direct application being constrained to quantities of process colorant that exceed a

U.S. PTO Customer No. 25280

Case# 5258

threshold minimum colorant application quantity, said process comprising the steps of:

- a. specifying the color component values of each process color represented by said set of process colorants, in combination with the color component values associated with said absorbent substrate;
  - b. specifying the target color in terms of a blend of process colorants, said blend being specified by concentration values of component process colorants;
  - c. specifying the number N of individual pixels comprising said superpixel;
  - d. determining appropriate proportions of said component process colorants to be applied to said individual pixels comprising said superpixel to form a process colorant blend that expressed said target color, wherein all such proportions involve process colorant concentrations that are greater than said threshold minimum colorant application quantity; and
  - e. constructing said superpixel by assigning specific concentrations of said component process colorants to specific individual pixels comprising said superpixel;
35. (Original) The process of Claim 34 wherein said superpixel is used to tile a uniformly colored pattern area.
36. (Original) The process of Claim 34 wherein said group of pixels express a target color as a dithering element in a dithered image.
37. (Original) The process of Claim 34 wherein said generated color component values accommodate selected physical characteristics of said absorbent substrate, and wherein said characteristics include those that determine substrate reflectivity.

U.S. PTO Customer No. 25280

Case# 5258

38. (Original) The process of Claim 37 wherein said accommodation involves the use of the Kubelka-Munk relationship.
39. (Original) The process of Claim 37 wherein said selected physical characteristics of said absorbent substrate include wicking characteristics.
40. (Original) The process of Claim 37 wherein said selected physical characteristics of said absorbent substrate include density characteristics.
41. (Original) The process of Claim 34 wherein the collective colorant concentration values of said pixels within said superpixel is about 100%.
42. (Original) The process of Claim 34 wherein the collective colorant concentration values of said pixels within said superpixel is greater than 100%.
43. (Original) The process of Claim 34 wherein said superpixel is constructed using a 2x2 Bayer Threshold Order Array.
44. (Original) The process of Claim 34 wherein said colorants are distributed within said superpixel to maximize the uniformity of the distribution of colorants within said superpixel.
45. (Original) The process of Claim 44 wherein the uniformity of said colorant distribution is determined using a Sum of Squared Deviations calculation.
46. (Original) The process of Claim 34 wherein, in Step (e), said assignment of specific concentrations of said process colors is made by successive rotations of a Bayer Threshold Order Array for each colorant in order to minimize a Sum of Squared Deviations calculation.
47. (Original) The process of Claim 34 wherein said pattern is constructed using at least one target color expressed through the formation of at least one superpixel and is displayed as a digitally defined image on a computer monitor.

U.S. PTO Customer No. 25280

Case# 5258

48. (Original) The process of Claim 47 which includes displaying individual pixels comprising said superpixel, prior to inter-pixel colorant commingling, on a computer monitor.
49. (Original) The process of Claim 34 wherein said assignment of specific concentrations of component process colorants to specific individual pixels is converted to instructions for actuating an array of dye applicators that collectively direct said process colorants onto said substrate surface in accordance with said pattern.



U.S. PTO Customer No. 25280

Case# 5258

**FORMAL MATTERS**

The Examiner states that Claims 34-49 were rejected because of the following informalities: In Claim 34, last line, "," must be changed to -- to correct an error in punctuation. Claims 34-49 will be allowed upon making this correction.

The Examiner has also objected to Claims 4-8,10,11,14,16,19-23, 25-27, 29, and 31 as being dependent upon a rejected base claim, but has indicated that the claims would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

U.S. PTO Customer No. 25280

Case# 5258

**ART REJECTIONS****Rejections Under 35 USC Section 102:**

The Examiner has rejected Claims 1, 2, 9, 12, 13, 18, 24, and 28 under 35 U.S.C. 102(b) as being anticipated by Sakurada et al. The Examiner asserts that the patent to Sakurada et al discloses an automated process for coloring a superpixel (a pixel defined by a plurality of pixels), defined within a computer aided design system 33,34, Fig. 4, containing a specified number of constituent pixels N (see col. 5, lines 14-15 which states that one pixel, viz. a "superpixel", is constituted by nine dots – each dot is a pixel since a pixel is any one of a plurality of small discrete elements that together constitute an image) and using a predefined set of process colors (yellow, magenta, cyan, and black as set forth in col. 4, lines 9), for use in coloring a pattern area (the area within one of the sets of nine squares shown in Fig. 6) having a specified target color (one of the "actual recording colors" recited in col. 4, lines 62-63), said process comprising the steps of defining a combination of said process colors (see col. 5, lines 14-21), each of said process colors having an individually specified concentration to be assigned to said superpixel that, when blended together, will produce said target color (note that the density, viz. the concentration, of the process color is individually specified for assignment to the combination of 9 pixels as set forth in col. 17-20), wherein said assignment of process colors to specific constituent pixels is constrained by a minimum specified concentration (the concentration has a minimum value corresponding to the "thin ink" referred to at col. 2, lines 62-63), and determining, within said combination of said process colors of Step (a), an assignment of specific concentrations of said process colors to specific constituent pixels that produces a desired distribution of colorants within said superpixel (see col. 6, lines 20-67 and col. 7, lines 1-6).

**Rejections Under 35 USC Section 103:**

The Examiner has rejected Claims 3, 15, 17, 30, 32, and 33 under 35 U.S.C. 103(a) as being unpatentable over Sakurada et al. in view of Adams. According to the Examiner, to display the target color of Sakurada et al. on a computer monitor as suggested by Adams (see col. 17, lines 28-46, col. 18, lines 8-19 and at 4,6,7,8, Fig. 1) would have been obvious since the target color could be displayed for color valuation purposes prior to printing the color on a substrate.